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(54) **DRY POWDER INHALER**

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(73) Assignee: **ICONOVO AB**

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A61M 11/00 (2006.01)

(52) **U.S. Cl.**
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(58) **Field of Classification Search**
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See application file for complete search history.

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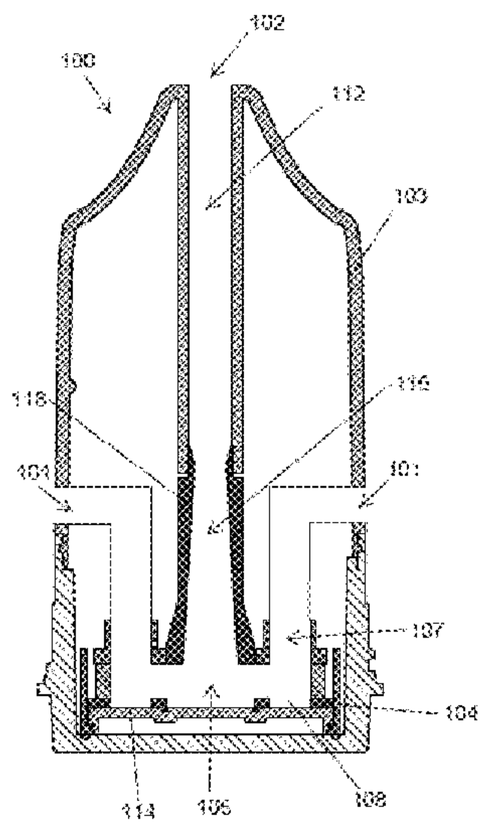
(57) **ABSTRACT**

A dry powder inhaler may include at least one air inlet, at least one air outlet, an air channel between said air inlet and outlet, and at least one medicament reservoir. The inhaler may include a dosage mechanism for arranging at least one dose of a medicament from said medicament reservoir between the air channel and the air outlet such that said at least one dose may be delivered upon inhalation at said air outlet. The dosage mechanism may include a dose disc with at least one cavity, wherein the dose disc may be rotatable between a dose collecting position, in which the cavity may be positioned in the medicament reservoir, and a dose administering position, in which the cavity may lie underneath the air channel. The inhaler may also include a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity for radial emptying of the medicament from the cavity during inhalation. Alternatively, the inhaler may include a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity and support the medicament in the cavity, wherein said dose disc may rotate in relation to the floor disc when the dose disc is rotated between the dose collecting position and the dose administering position to grind any residual medicament in the cavity.

21 Claims, 4 Drawing Sheets



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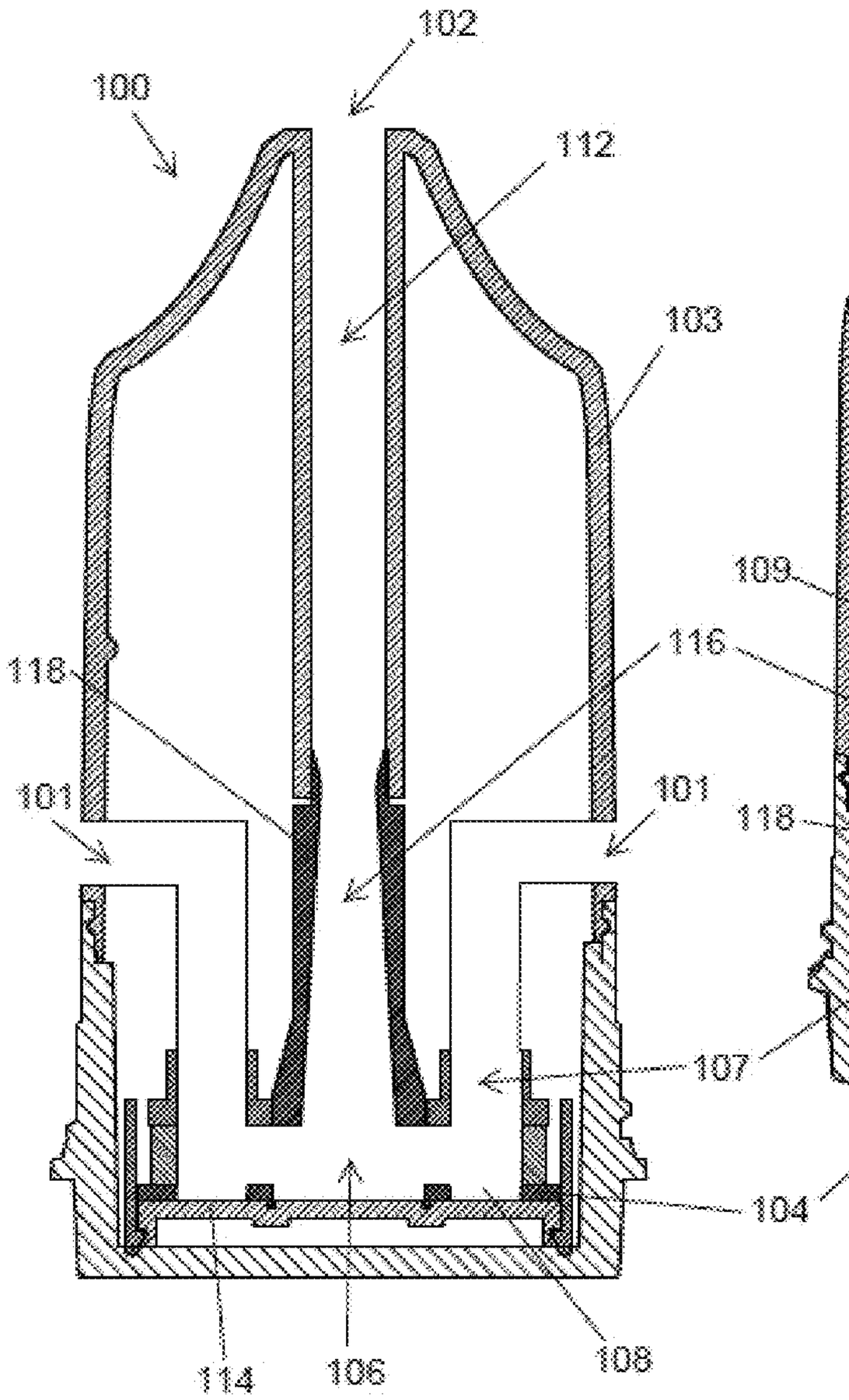
102
100
112
103
118
116
101
101
107
104
114
106
108

Fig. 1

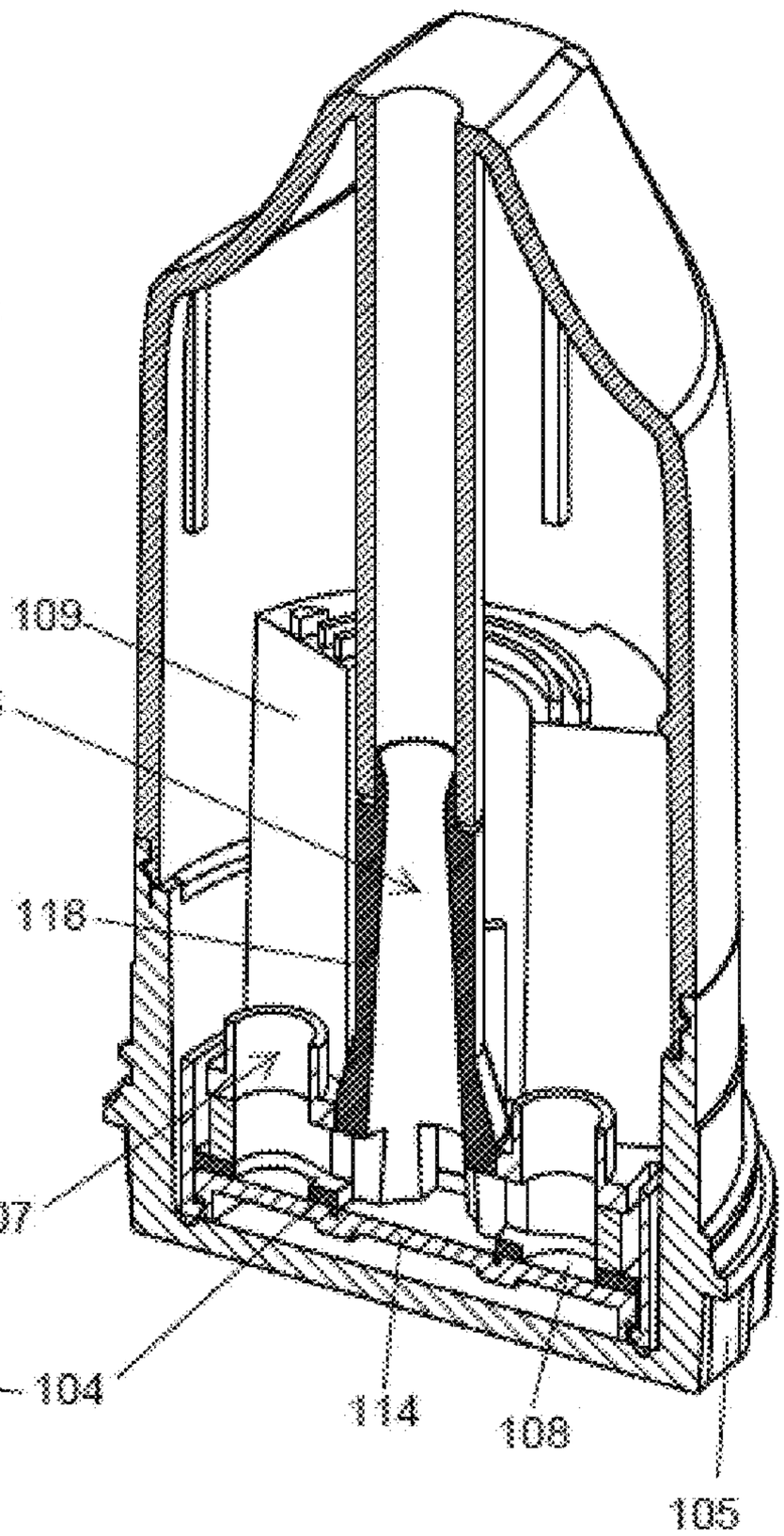
109
116
118
114
108
105

Fig. 2

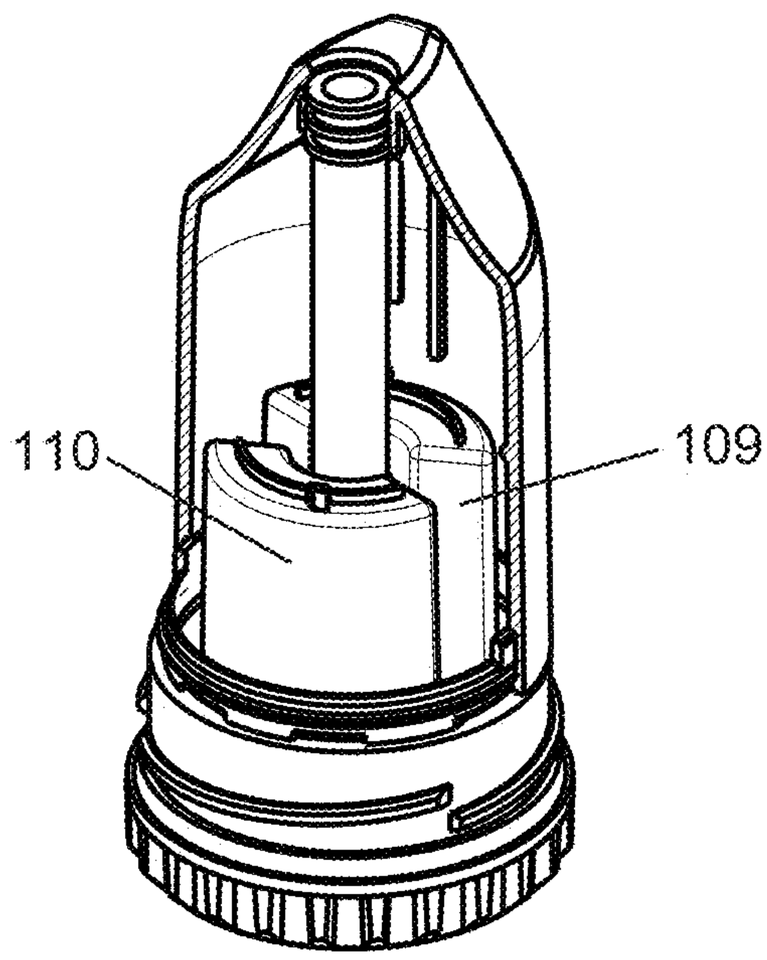

Fig. 3

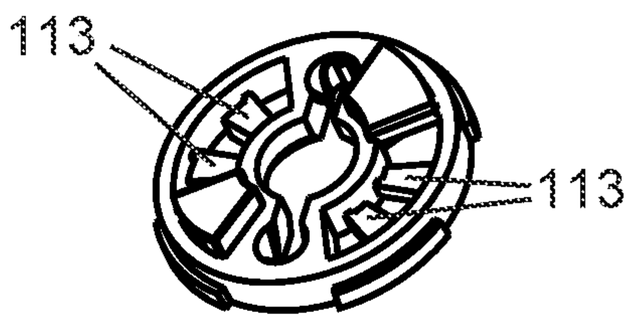

Fig. 4

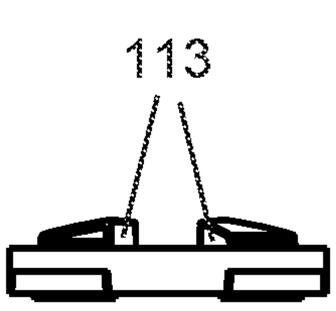

Fig. 5C

Fig. 5D

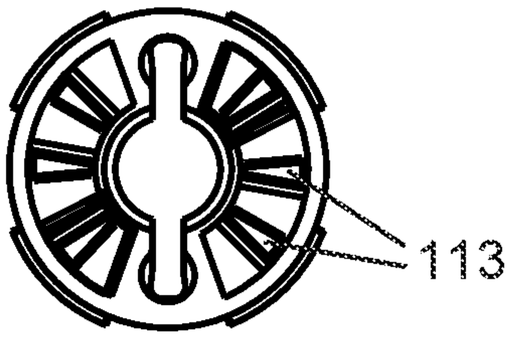

Fig. 5A

Fig. 5E

Fig. 5F

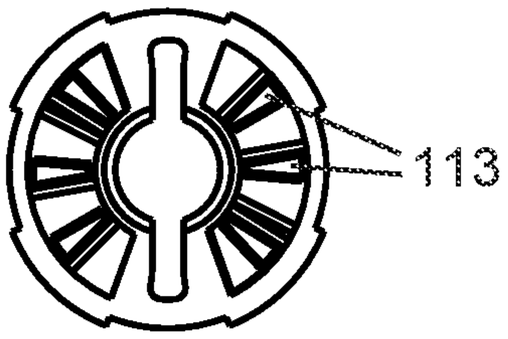

Fig. 5B

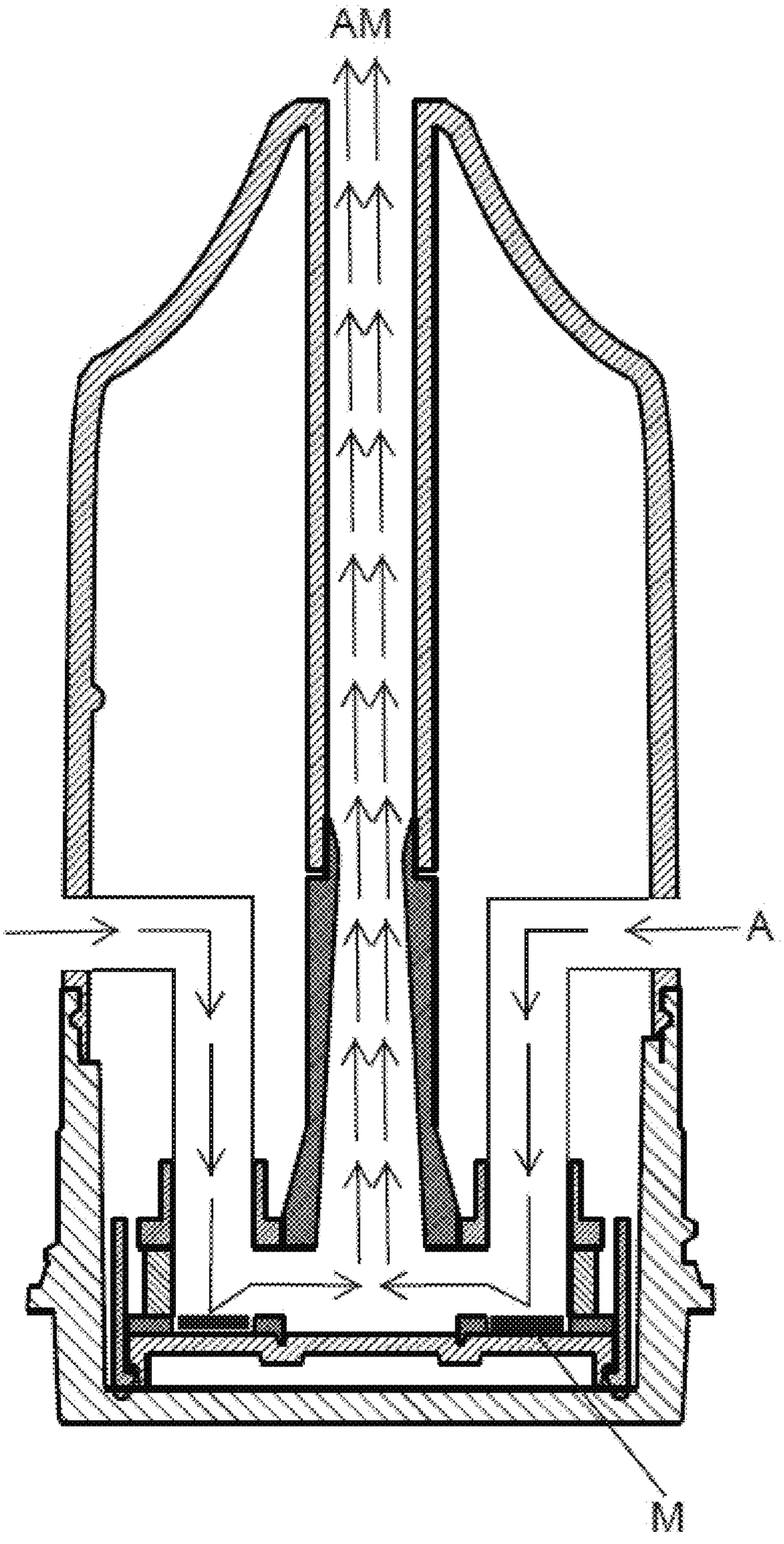

Fig. 6

DRY POWDER INHALER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to International Patent Application No. PCT/EP2016/060275, filed on May 9, 2016, Swedish Patent Application No. 1550594-4, filed on May 8, 2015, and Swedish Patent Application No. 1550595-1, filed on May 8, 2015, the contents of all of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

This invention pertains in general to the field of medicament inhalers, and more particularly to dry powder inhalers. Even more particularly, the invention pertains to a medicament inhaler comprising a dosage mechanism and a floor disc abutting the dosage mechanism.

BACKGROUND

Inhalers have been widely used in the pharmaceutical field for treatment of respiratory and/or other diseases. Numerous drugs, medications and other substances are inhaled into the lungs using the inhalers for rapid absorption of the drug etc. in the blood stream and for local action in the lung.

Inhaled drugs fall into two main categories, one being in the form of liquids, including suspensions, and the other being powders. The choice of liquids or powders depends on the characteristics of the drugs, medications, etc. to be inhaled.

The most common type of inhaler is the pressurized metered-dose inhaler. In this type of inhaler medication is most commonly stored in solution in a pressurized canister that contains a propellant, although it may also be a suspension. The canister is attached to a plastic, hand-operated actuator. On activation, the metered-dose inhaler releases a fixed dose of medication in aerosol form.

Another kind of inhaler is a nebulizer, which supplies medication as an aerosol created from an aqueous formulation.

The kind referred to herein is yet another type, in the form of a dry powder inhaler. A dry powder inhaler releases a pre-metered, capsuled, dose or a device-metered dose of powdered medication that is inhaled through the inhaler. Inhalers with a device-metered dose of powdered medication are normally inhalers with a medication reservoir containing powdered medication, from which metered doses are withdrawn through the use of different dose metering arrangements, said doses then being inhaled.

Dry powder inhalers need to deliver a particle size that is predominantly below 5 microns, and preferably between 1 micron and 3.3 microns, for maximum effectiveness. However, such small particles are often very cohesive due to high surface energy. Agglomeration may be worsened by moisture and/or when the medication comprises more than one active substance, since the different active substances may have such properties as to form agglomerations with each other or with pharmaceutical carriers etc. Agglomeration of small particles is a problem which results in the active particles leaving the inhaler as large agglomerates.

EP0237507 discloses a powder inhaler with a device metered dose, comprising a medicament chamber, a dosing mechanism, and a flow path from an air inlet to an air/medicament outlet. Deflectors are arranged in the flow path

to increase deaggregation of medicament. However, this device is limited to medicaments having one active substance or active substances that are compatible with each other during storage. Additionally, medicament will accumulate at the deflectors thus decreasing uniformity of the dosage.

An additional problem of prior art inhalers is that they are either suitable for micronized formulations or carrier based formulations never both or combinations of these.

In view of these drawbacks and limitations of the prior art, what is needed is a dry powder inhaler device in which effective and satisfactory dispersion of the dry powder is obtained, which inhaler can administer medicament comprising substances which are incompatible in a mixture, and an inhaler with increased deaggregation and a more uniform dosage, in which inhaler there is no risk of multiple dosing, as well as an inhaler which is robust and suitable for both micronized formulations and/or carrier based formulations.

SUMMARY

Accordingly, the present invention preferably seeks to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination and solves at least the above mentioned problems by providing in a first aspect a dry powder inhaler comprising: at least one air inlet, at least one air outlet, and an air channel between said at least one air inlet and said at least one air outlet; at least one medicament reservoir; a dosage mechanism for arranging at least one dose of a medicament from said at least one medicament reservoir between the air channel and the air outlet such that said at least one dose may be delivered upon inhalation at said air outlet, wherein the dosage mechanism comprises a dose disc with at least one cavity, wherein the dose disc may be rotated between a dose collecting position wherein the cavity is positioned in the medicament reservoir, and a dose administering position wherein the cavity lies underneath the air channel; and a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity for radial emptying of the medicament from the cavity during inhalation.

In a second aspect there is provided a dry powder inhaler comprising: at least one air inlet, at least one air outlet, and an air channel between said at least one air inlet and said at least one air outlet; at least one medicament reservoir; a dosage mechanism for arranging at least one dose of a medicament from said at least one medicament reservoir between the air channel and the air outlet such that said at least one dose may be delivered upon inhalation at said air outlet, wherein the dosage mechanism comprises a dose disc with at least one cavity, wherein the dose disc may be rotated between a dose collecting position wherein the cavity is positioned in the medicament reservoir, and a dose administering position wherein the cavity lies underneath the air channel; and a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity and support the medicament in the cavity, wherein said dose disc rotates in relation to the floor disc when the dose disc is rotated between the dose collecting position and the dose administering position to grind any residual medicament in the cavity.

Further advantageous embodiments are disclosed below and in the appended patent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, features and advantages of which the invention is capable will be apparent and elucidated from

the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which;

FIG. **1** is a cross sectional view along a longitudinal axis of an inhaler in the dose administering position according to one embodiment of the present invention; and

FIG. **2** is a perspective and cross sectional view of the inhaler in FIG. **1**. Air inlets are omitted from FIG. **2** for clarity.

FIG. **3** is a perspective and partial cross sectional view of the inhaler in FIG. **1** showing two medicament reservoirs. Air inlets are omitted from FIG. **3** for clarity.

FIG. **4** is a perspective view showing a medicament scraper for use in the inhaler in FIG. **1**.

FIGS. **5**A-**5**F shows top, bottom and four side views of the medicament scraper in FIG. **4**.

FIG. **6** is a cross sectional view along a longitudinal axis of the inhaler in FIG. **1** wherein the air (A) and air/medicament flows (AM) through this inhaler are disclosed.

DETAILED DESCRIPTION

The following description focuses on an embodiment of the present invention applicable to a medicament inhaler, and in particular to a dry powder drug inhaler with more than one medicament reservoir, such as two medicament reservoirs. However, it will be appreciated that the invention is not limited to this application but may be applied to many other inhalers having an inlet and an outlet, as well as a medicament reservoir.

FIGS. **1** and **2** illustrate a dry powder drug inhaler **100**. The dry powder drug inhaler **100** comprises air inlets **101** and an air outlet **102**. The outlet **102** is arranged at a first end of the dry powder drug inhaler **100** while the inlets **101** are arranged at a zone in an opposite second end of the dry powder drug inhaler **100**. The outlet **102** is arranged centrally along the longitudinal axis of the dry powder drug inhaler **100**. The inlets **101** may be arranged at the periphery of the dry powder inhaler **100** in a radial position in relation to the longitudinal axis of the dry powder drug inhaler **100**, such that the inlets **101** lead inhaled air transversally and radially towards the central portion of the dry powder inhaler **100**.

Although not illustrated in FIGS. **1** and **2**, the inlets **101** may also be positioned with a direction that is parallel to the central axis of the dry powder inhaler **100**.

The number of inlets and outlets may be different from what is disclosed in FIGS. **1** and **2**. The number of inlets may for example be adjusted in accordance with needs and specific inhaler design such that a number of smaller air inlets, for reducing pressure fall over the inhaler, are arranged circumferentially on the dry powder inhaler **100**. In a similar manner the number of air outlets may be adjusted in accordance with needs and specific inhaler design.

The different parts of the dry powder inhaler **100** may be manufactured in a suitable material, such as injection moldable plastics, such as thermoplastics.

The dry powder inhaler **100** comprises three major parts in the form of (i) an upper proximal reservoir housing **103** with an inhalation chimney **112**, (ii) a dosage mechanism **118** comprising a dose disc **104** having at least one cavity **108**, a mixing and deaggregation chamber **106** adjacent to the at least one cavity **108**, and a conduit **116** extending distally from the chamber **106**, and (iii) a lower distal twister **105** having a floor disc **114**. The reservoir housing **103** and the twister **105** cooperate so as to house the dosage mechanism **118** and the floor disc **114** in between housing **103** and twister **105**. The chimney **112** of the reservoir housing **103** cooperates with the conduit **116** of the dosage mechanism **118** such that the dose disc **104** may be rotated between a dose administering position and a dose collecting position when the reservoir housing **103** is rotated. The floor disc **114** is connected to twister **105** so that floor disc **114** only moves when twister **105** is rotated as will be described further below. This may be accomplished by connecting the floor disc **114** and the twister **105** via interconnecting grooves and ribs, or letting the twister **105** extend longitudinally around the floor disc **114** as disclosed for example in FIG. **1**. Preferably, the rotation of the dose disc **104** has two end positions corresponding to the dose administering position and the dose collecting position in its relation with the reservoir housing **103** in a known manner.

The dose administering position is illustrated in FIGS. **1** and **2**. In the dose administering position, the inlets **101** are in communication with the mixing and deaggregation chamber **106** via air channels **107**. The air channels **107** direct the flow of air from inlets **101** initially downwards onto cavities **108** in the dose disc **104**. Hence, in the dose administering position the cavities **108** lie underneath and in line with the air channels **107**. The combination of the inhaled air from channels **107** and the medicament from cavities **108** then flows radially to the chamber **106** as will be described further below with respect to FIG. **6**. When the dose disc **104** is rotated into a dose collecting position (not shown), the chamber **106** and the cavities **108** are rotated away from communication with the inlets **101** and air channels **107**. Instead, the cavities **108** are rotated into medicament reservoir **109** (shown in FIG. **2** and FIG. **3**) and medicament reservoir **110** (shown in FIG. **3**), wherein the cavities **108** may collect a medicament housed in the reservoirs **109** and **110**. The medicament contained in the medicament reservoir **109** may be a medicament different from the medicament contained in the medicament reservoir **110**. Due to the presence of two reservoirs **109** and **110**, the inhaler **100** may deliver two substances in one inhalation, said two substances otherwise being incompatible meaning that these two substances would not be possible to be comprised in one joint reservoir. Thus, the dry powder inhaler device **100** can effectively and satisfactorily disperse two dry powders and can administer a medicament comprising two or more substances which are incompatible in a mixture or are preferably stored in separate reservoirs for other reasons.

It is possible to arrange the dose disc **104** and the cavities **108** thereof such that when a first set of two cavities **108** lie underneath and in line with the air channels **107**, i.e. in a dose administering position, a second set of two cavities **108** are positioned in the medicament reservoirs **109**, **110** respectively. In this arrangement the inhaler has two medicament reservoirs, two air inlets, and one dose disc with four cavities. Additionally, the distribution of the cavities **108** on the dose disc **104** is such that the dose disc **104** may be rotated in one direction only meaning that when the second set of two cavities **108** lie underneath and in line with the air channels **107**, the first set of cavities **108** are positioned in the medicament reservoirs **109**, **110** respectively. It is also possible for the dose disc **104** to be rotated in a first direction so that cavities **108** lie underneath and in line with the air channels **107** in a dose administering position, and then for the dose disc **104** to be rotated in the opposite direction into the dose collecting position, and thereafter again for the dose disc to be rotated in said first direction back into the dose administering position. When the dose disc **104** is rotated in a first direction into the dose administering position and the opposite direction into the dose collecting position, the dose

disc **104** may have rotational stops in the dose administering position and the dose collecting position, respectively, to ensure accurate alignment of the cavities **108** under air channels **107** and positioning in the medicament reservoirs **109**, **110** respectively.

It is also envisioned that an inhaler provided with more than two, such as three, four, five, or six, reservoirs **109**, **110** with the same arrangement of inlets, outlets, air channels, dose disc, cavities etc., is within the ambit of the present invention. For example, the inhaler **100** may have three medicament reservoirs **109**, three air inlets **101**, and a dose disc with three cavities **108**. Alternatively, the inhaler **100** may have four medicament reservoirs **109**, four air inlets **101**, and a dose disc with four cavities **108**. It is preferred however that the inhaler **100** have two air inlets **101**, two air channels **107**, one air outlet **102**, two medicament reservoirs **109**, **110**, and one dose disc **104** with two cavities **108**.

It is also envisioned that the inhaler **100** may be provided with a different dosage mechanism than the one disclosed above, for example electrical drive of different parts, and using paddles instead of the dose disc **104**. However, use of the dosage mechanism **118** having the dose disc **104** and its cooperation with chimney **112** of the upper housing **103** and the reservoirs **109**, **110** allows for a very cost effective solution while simultaneously ensuring high dose accuracy and the other benefits disclosed herein.

The floor disc **114** is located underneath dose disc **104** and extends substantially across the diameter of the dose disc **104**. The floor disc **114** abuts the dose disc **104** and closes the bottom of the cavities **108** to provide support for the medicament in cavities **108** after collection of the medicament from the reservoirs **109** and **110**. Thus, the floor disc **114** forms a bottom of the cavity **108**, wherein said dose disc **104** rotates in relation to the floor disc **114** when the dose disc **104** is rotated between the dose collecting position and the dose administering position. Floor disc **114** moves with lower twister **105** when the twister **105** is rotated. The floor disc **114** does not rotate independently of lower twister **105**. In use the dose disc **104** is rotated independently of the floor disc **114** while remaining in contact with floor disc **114**. The arrangement of the dose disc **104** to the floor disc **114** allows the inhaler to be used with free flowing powder medicaments such as carrier based formulations that are not particularly susceptible to aggregation in the cavities **108**. The floor disc **114** supports the free flowing powder so that cohesive forces between particles of the powder are not necessary to retain the powder in the cavity. The arrangement further allows for a more robust inhaler that can absorb shock, shaking or other types of impact with little to no disturbance or loss of medicament from cavities **108** prior to inhalation. Even if the inhaler is vigorously shaken resulting in displacement of some medicament from a cavity **108**, there is no risk of multiple dosing as the dose disc **104** is not rotated into the medicament reservoirs (again) prior to inhalation of the medicament during correct use of the inhaler. The arrangement also allows for removal of any medicament residue from the cavity **108** when the dose disc **104** is rotated over the floor disc **114**. Frictional forces between the dose disc **104** and the floor disc **114** during the rotational movement result in attrition or grinding of the medicament residue that is later inhaled by the user or returned to the medicament reservoirs. These frictional forces are maximized during simultaneous rotation of the dose disc **104** and the floor disc **114** against each other by rotating the reservoir housing **103** and the twister **105** in opposite directions. This prevents accumulation of medicament residue in the cavities **108** and is most beneficial when using the inhaler with a medicament(s) susceptible to aggregation in the cavities **108**. As illustrated in FIGS. **1** and **2**, the floor disc **114** may be suspended by a small distance above lower distal twister **105** although it is possible that the floor disc **114** may lie directly on top of lower distal twister **105**.

The air channels **107** have a right angle conformation as disclosed in the embodiment in FIG. **1**. The right angle conformation is such that the air channels **107** start at inlets **101** and extend downstream (during inhalation) in a central and transversal direction, where after they bend downwards at a right angle (90 degrees) to extend in a longitudinal and distal direction before ending above and in line with the cavities **108** (in the dose administering position). In this way, when medicament lies in the cavities **108**, the air flow direction will facilitate initial deaggregation of the medicament from the cavities **108**. This ensures that the medicament in the cavities **108** will be dispersed into the air flow and enter into the chamber **106**. This arrangement means for example that the reservoirs **109**, **110** may comprise a dry powder medicament in the form of a micronized formulation or a carrier based formulation, or mixtures thereof. The inhaler **100** may then for example comprise a dry powder medicament in form of a micronized formulation in the first reservoir **109** and a free-flowing dry powder medicament in form of a carrier based formulation in the second reservoir **110**.

It is of course not necessary for the air channels **107** to have a right angle conformation as illustrated in FIG. **1**. The air channels **107** could also curve inwards and downwards from inlets **101** before ending above and in line with the cavities **108**. Other air channel conformations are considered within the ambit of the invention provided the inhaled air flow facilitates deaggregation of the medicament from the cavities.

Depending on the medicament to be administered, and the formulation thereof, the cavities **108** may take the form of a single circular shape when viewed from directly above or below the inhaler **100** as illustrated by the semi-circular shape of cavities **108** in FIG. **2**. The single circular shape will be of approximately the same size and shape as the air channel **107**. This will be most suitable when the medicament is not readily susceptible to aggregation and/or a large dose is desired. Other medicaments which tend to aggregate more may form an undesirable "plug" in the cavity **108** which is not readily dispersible during inhalation. Then it may be preferable to make several cavities **108** each having a relatively smaller diameter than a single circular shape as illustrated in FIGS. **1** and **2**. The several smaller cavities will continue to lie underneath one of the air channels **107** which remains unchanged in size and shape. An inhaler with several smaller cavities lying underneath one air channel **107** also allows for delivery of a smaller amount of powder. This feature also adds the possibility to combine or adapt the inhaler **100** for deliverance of micronized formulations and/or carrier based formulations.

The reservoirs **109**, **110** may be provided with medicament scrapers **113** illustrated in FIGS. **4** and **5**A-**5**F. The scrapers are suspended at the bottom of the reservoirs **109**, **110** such that they bear upon the dose disc **104**. The scrapers will pass over the cavities **108** of the dose disc **104** so that excessive medicament is removed from the cavities **108** to ensure correct dose volume. The scrapers will also aid in compacting medicament in the cavities **108** which will improve retention of medicament in cavities **108** when the dose disc has been rotated into the dose administering position. Since the scrapers **113** are suspended at the bottom of the reservoirs **109**, **110** they will automatically slide along

the upper proximal surface of the dose disc **104**, when the dose disc **104** is rotated between the dose administering position and dose collecting position. Preferably, each reservoir **109**, **110** has a number of scrapers evenly distributed along the bottom of the reservoirs **109**, **110**. In this way the scrapers do not only aid in obtaining correct dose volume and dose compacting but also aid in distributing medicament at the bottom of the reservoirs **109**, **110**. The number of scrapers per reservoir **109**, **110** could for example be selected in the interval of 1 to 6, such as 2 to 4, such as 3. It is also envisioned that the scrapers are arranged in an uneven distribution in the reservoirs **109**, **110** if certain reservoirs are configured such that an uneven distribution of the scrapers will have a beneficial effect on the medicament distribution along the bottom of the reservoirs **109**, **110**

During inhalation the medicament is emptied radially from the cavity with the air flow from the air channels **107** into the chamber **106** wherein the air/medicament streams from the different air channels **107** and cavities **108** will cross, such that the medicament agglomerates will collide to increase deaggregation, where after a jet stream of finely dispersed medicament and air will continue through conduit **116** and inhalation chimney **112** out of the inhalator **100** through outlet **102** and into the lungs of the user. This radial emptying of the cavities **108** will be described further below with respect to FIG. **6**. The conduit **116** and the chimney **112** increases jet formation, allowing for a maintained low aggregation of medicament, hence increasing potential of medicament to reach far into the lungs of the patient. The conduit and chimney are generally tubular, but could optionally be provided with deflectors, to further increase jet creation. Such deflectors could be bumps or spiral-shaped ridges, extending along the length of the conduit and/or chimney from the chamber **106** to the air outlet **102**. The chimney **112** does not necessarily have to be directed upwardly; it can just as well be directed downwardly or to the sides, whereby the outlet **102** is instead positioned at the bottom or on the sides, respectively. Additionally, the chimney **112** does not have to be generally tubular, but could be bent or sinus-shaped, depending on where on the inhaler **100** it is preferred to position the outlet **102**. For flow characteristics and dose reliability and maintenance, it is however preferred to have it directed upwardly and generally tubular with optional deflectors. The general shapes of the conduit **116** and the chimney **112** may also be such as to have differences in cross-sectional area, such as is present in a cone-shaped chimney. In this way, the flow velocity in the conduit and chimney may be regulated so as to help in deaggregation at chosen parts.

During use of the inhaler **100** the user will then simply rotate the upper housing **103** in one direction and thus the dose disc **104** into a dose collecting position if the dose disc is in a dose administering position. Thereafter, the upper housing **103** and the dose disc **104** are rotated preferably into the opposite direction to reach the dose administering position. If the dose disc **104** is already in the dose collecting position then of course the first rotation into the dose collecting position may be omitted. During these rotations, the scraper **113** will fill the cavities **108** of the dose disc **104** in the reservoirs **109**, **110**. After the dose disc **104** has been rotated into the dose administering position the cavities **108** are filled with medicament—optionally two different medicaments—and lie underneath the air channels **107**. Then the user puts his/her mouth at outlet **102** and inhales. During inhalation air A will enter the inhaler **100** through inlets **101** and flow through air channels **107** to disperse and carry therewith the medicament(s) M from the cavities **108** in a radial direction in accordance with the arrows shown in FIG. **6**. The air/medicament flow AM will then enter the chamber **106**. In the chamber **106**, the air/medicament flows AM from the air channels **107** and cavities **108** will cross each other or coincide with each other, such that deaggregation of the medicaments M will increase which may increase dose uniformity since the need for deflectors then is decreased. The flow characteristics, such as jet stream formation, will also increase. This feature allows the possibility to combine or adapt the inhaler **100** for deliverance of micronized formulations and/or carrier based formulations. Of course, it is also possible to combine the feature of crossing or coinciding flows from the two air channels **107** with deflectors, even though the need thereof is decreased. Thereafter, the air/medicament flow AM now comprising air/medicament flows from both air channels **107** and cavities **108**, will go up through the conduit **116**, the inhaler chimney **112**, and finally through outlet **102** into the lungs of the user. A similar sequence of steps is then repeated the next time the inhaler **100** is required i.e. the user rotates the upper housing **103** and thus the dose disc **104** into a dose collecting position to fill the cavities **108** with a medicament(s) then the user rotates the dose disc **104** back into the dose administering position and inhales at outlet **102** as described immediately above.

The structure of, and functional relationship between, the cavities **108**, reservoirs **109**, **110** and the separate dose collecting and dose administering positions allows for no risk of multiple dosing by the user. In use the medicaments remain in the cavities **108** until inhalation. If inhalation is not commenced or is no longer required by the user, the cavities **108** carrying the medicaments may be rotated back into the reservoirs **109**,**110**.

Although, the present invention has been described above with reference to specific embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the invention is limited only by the accompanying claims.

In the claims, the term "comprises/comprising" does not exclude the presence of other elements or steps. Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented by e.g. a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly advantageously be combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. In addition, singular references do not exclude a plurality. The terms "a", "an", "first", "second" etc do not preclude a plurality. Reference signs in the claims are provided merely as a clarifying example and shall not be construed as limiting the scope of the claims in any way.

The invention claimed is:

1. A dry powder inhaler comprising:

at least two air inlets, at least one air outlet, and at least two air channels each between a corresponding one of said at least two air inlets and said at least one air outlet;

at least one medicament reservoir;

a dosage mechanism for arranging at least one dose of a medicament from said at least one medicament reservoir between the air channel and the air outlet such that said at least one dose may be delivered upon inhalation at said air outlet, wherein the dosage mechanism includes a dose disc with at least one cavity, and wherein the dose disc is rotatable between a dose collecting position, in which the cavity is positioned in the medicament reservoir, and a dose administering position, in which the cavity lies underneath one of the

air channels, and wherein the dosage mechanism includes a mixing and deaggregation chamber between the at least two air channels, and a conduit extending distally from the mixing and deaggregation chamber towards the at least one air outlet;

a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity for radial emptying of the medicament from the cavity during inhalation; and

an upper proximal reservoir housing with an inhalation chimney interconnecting the conduit and the air outlet, the inhalation chimney cooperating with the conduit to rotate the dose disc when the upper proximal reservoir housing is rotated.

2. The inhaler according to claim **1**, wherein the floor disc is connected to a lower distal twister.

3. The inhaler according to claim **2**, wherein the floor disc is suspended above the lower distal twister.

4. The inhaler according to claim **1**, wherein at least one of the chimney and the conduit includes deflectors.

5. The inhaler according to claim **1**, further comprising a second medicament reservoir, wherein the dose disc has two cavities, each cavity configured to withdraw a dose of the medicaments from each of the first and second medicament reservoirs in the dose collecting position.

6. The inhaler according to claim **1**, further comprising a second medicament reservoir, wherein the dose disc has four cavities and is configured such that a first set of two cavities lies underneath the air channels while a second set of two cavities is positioned in the medicament reservoirs.

7. The inhaler according to claim **1**, wherein the cavity is circular and corresponds with a size of the overlying air channel.

8. The inhaler according to claim **1**, wherein more than one cavity lies underneath the air channel, each cavity being of smaller size relative to the air channel.

9. The inhaler according to claim **1**, wherein at least one medicament scraper is suspended in the at least one medicament reservoir, such that the at least one medicament scraper bears upon the dose disc.

10. The inhaler according to claim **9**, wherein a number of scrapers in the medicament reservoir is selected in an interval from 1 to 6.

11. A dry powder inhaler comprising:

at least two air inlets, at least one air outlet, and at least two air channels each between a corresponding one of said at least two air inlets and said at least one air outlet;

at least one medicament reservoir;

a dosage mechanism for arranging at least one dose of a medicament from said at least one medicament reservoir between the air channel and the air outlet such that said at least one dose may be delivered upon inhalation at said air outlet, wherein the dosage mechanism comprises a dose disc with at least one cavity, and wherein the dose disc is rotatable between a dose collecting position, in which the cavity is positioned in the medicament reservoir, and a dose administering position, in which the cavity lies underneath one of the air channels, and wherein the dosage mechanism includes a mixing and deaggregation chamber between the at least two air channels, and a conduit extending distally from the mixing and deaggregation chamber towards the at least one air outlet;

a floor disc abutting the dose disc underneath the cavity to form a bottom of the cavity and support the medicament in the cavity, wherein said dose disc rotates in relation to the floor disc when the dose disc is rotated between the dose collecting position and the dose administering position to grind any residual medicament in the cavity; and

an upper proximal reservoir housing with an inhalation chimney interconnecting the conduit and the air outlet, the inhalation chimney cooperating with the conduit to rotate the dose disc when the upper proximal reservoir housing is rotated.

12. The inhaler according to claim **11**, wherein the floor disc is connected to a lower distal twister.

13. The inhaler according to claim **12**, wherein the floor disc is suspended above the lower distal twister.

14. The inhaler according to claim **11**, wherein the dose disc and the floor disc are rotated against each other by rotating the upper proximal reservoir housing and the lower distal twister in opposite directions simultaneously.

15. The inhaler according to claim **11**, wherein at least one of the chimney and the conduit includes deflectors.

16. The inhaler according to claim **11**, further comprising a second medicament reservoir, wherein the dose disc has two cavities, each cavity configured to withdraw a dose of the medicaments from each of the first and second medicament reservoirs in the dose collecting position.

17. The inhaler according to claim **11**, further comprising a second medicament reservoir, wherein the dose disc has four cavities and is configured such that a first set of two cavities lies underneath the air channels while a second set of two cavities is positioned in the medicament reservoirs.

18. The inhaler according to claim **11**, wherein the cavity is circular and corresponds with a size of the overlying air channel.

19. The inhaler according to claim **11**, wherein more than one cavity lies underneath the air channel, each cavity being of smaller size relative to the air channel.

20. The inhaler according to claim **11**, wherein at least one medicament scraper is suspended in the at least one medicament reservoir, such that the at least one medicament scraper bears upon the dose disc.

21. The inhaler according to claim **20**, wherein a number of scrapers in the medicament reservoir is selected in an interval from 1 to 6.

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